CHAIR BACK REST WITH IMPROVED RESILIENCE AND SUPPORT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application is related to the patent applications "Chair with Backward and Forward Passive Tilt Capabilities," attorney docket number 087522-785-323; "Horizontally Adjustable Chair Arm Rest," attorney docket number 087522-785-329; "Vertically Adjustable Chair Arm Rest," attorney docket number 087522-785-347; "Chair with Adjustable Seat Depth," attorney docket number 087522-785-349; and "Chair with Tilt Lock Mechanism," attorney docket number 087522-785-350; each application being filed on even date herewith and incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] This invention relates to a chair having a seat portion and a backrest portion, wherein the backrest includes means for providing improved resilience and support. In particular, the invention relates to a chair for office use wherein the backrest includes means for providing improved resilience and support, which means automatically self-adjusts as the backrest portion reclines.

[0003] It is known in the art of office seating design to provide an office chair with a backrest portion that adjustably reclines in response to pressure exerted by the user's back, and then returns to its original position as the user's back moves forward. Such chairs are typically designed to provide a support for the user's lumbar region when the backrest portion is in the fully upright position. The lumber support can be either fixed or manually adjustable. One difficulty with such prior art chairs is that a fixed lumbar support, or even one that is manually adjustable, may not meet and comfortably support

the lumbar regions of users of different heights. Another difficulty with such prior art chairs is that as the user reclines back, the position of the user's lumbar region shifts with respect to the position of the fixed lumbar support in the backrest portion. Thus as the backrest portion reclines, the user's lumbar region may not receive optimum support over the range of motion of the backrest.

[0004] It is thus one object of the invention to provide a backrest portion for a chair that includes means for automatically providing resilience and support for a user's back.

[0005] It is another object of the invention to provide a backrest portion for a chair that includes means for providing lumbar support that automatically self-adjusts to comfortably support users of different heights.

[0006] It is still another object of the invention to provide a backrest portion for a chair that includes means for providing adjustable resilience and support that automatically self-adjusts to comfortably support users as the user changes positions against the backrest, and as the backrest portion reclines over different angles of inclination in response to pressure exerted by the user's back.

SUMMARY OF THE INVENTION

[0007] These and other objects of the invention are met by a chair having a seat portion and a backrest portion, the backrest portion being capable of reclining in response to pressure exerted thereon by a user's back, the backrest portion including in its interior a means for providing automatically self-adjusting resilience and support, said means comprising a fluid-containing cushion. The cushion is substantially coextensive with at least that region of the surface of the backrest portion that engages the user's lumbar

region. The cushion provides automatically varying pressure in response to the variable pressure exerted by different regions of the user's lumbar region, or other regions of the user's back that overlay the cushion. The cushion automatically accommodates users of different heights, and automatically self-adjusts to variations in applied pressures as the backrest portion reclines through a range of angles.

[0008] In a preferred embodiment, the cushion comprises two sheets of flexible, air-impermeable plastic film, sealed together so as to define a volume having a lower region and an upper region. The cushion preferably has seams that define a plurality of channels extending generally from the lower region to the upper region when the cushion is installed in a backrest portion of a chair. Each channel is partially filled with fluid. As the user leans his or her back against the back rest, greater pressure will be exerted against the cushion by the user's upper back and shoulders than by the user's lumbar region. This will force more fluid from the upper region of the cushion downward toward the lower region, to provide increased resilient lumbar support for the user. The precise location of the increased lumbar support can vary along the length of the channels, so as to provide improved lumbar support as an individual user shifts position in the chair, and for users of different heights. Moreover, as the individual user reclines the backrest, the location of the increased lumbar support can shift in response to variable pressures exerted by different regions of the user's back, so that the improved backrest automatically provides optimum resilient back support to the user at any angle of inclination.

DESCRIPTION OF THE FIGURES

[0009] The present invention is more readily understood by reference to the figures, wherein

[0010] FIG. 1 is a side cross-sectional view of a chair having a backrest of the invention;

[0011] FIG. 2 is a front cutaway view of an embodiment of a chair backrest of the invention therein;

[0012] FIG. 3 is an end-on view of the cushion of FIG. 2; and

[0013] FIG. 4 is a front-elevational view of a another embodiment of a cushion for use in the instant invention.

DETAILED DESCRIPTION OF THE INVENTION

[0014] As illustrated in FIG. 1, a chair 10 includes a backrest 12 having a forward facing side 14 and a rearward facing side 16. The backrest 12 comprises a substantially rigid support member 18, covered at least on its forward facing side 14 with an upholstery-type covering 20 such as fabric, vinyl or leather. Optionally a pad 22 of foam or other resilient material such as is known in the art is disposed on the forward facing surface of substantially rigid support member 18.

[0015] In accordance with the invention, a means for providing resilience and support for a user's back comprises a fluid-containing cushion 30 disposed between substantially rigid support member 18 and upholstery cover 20. An optional pad 23 of foam or other resilient material can be disposed between cushion 30 and upholstery cover 20. Cushion

30 comprises a first layer 32 and a second layer 34, each of the layers being made of an air-impermeable plastic, the layers being hermetically sealed together about their respective peripheries to form a peripheral seal 36. The cushion 30 preferably is sized and dimensioned to be substantially co-extensive with at least that region of the backrest 12 that will experience pressure exerted by the back of a user of the chair 10, extending from the upper back and shoulders down to and including the lumbar region. For ease of reference, the structure of the invention will be discussed in terms of a lower region 40 and an upper region 42, although it will be appreciated that the actual proportions of the inventive cushion that will serve as lumbar support region and upper back support region, respectively, will depend upon the size and height of the individual user.

[0016] In a preferred embodiment, the two layers 32 and 34 of cushion 30 are further joined by a plurality of seams 37. The seams 37 together with the peripheral seal 36 define a plurality of channels 38, that generally extend from lower region 40 to upper region 42. The channels can be substantially vertical, as illustrated in the figures, or they can be oriented at different angles.

[0017] Each channel 38 contains a fluid. In the illustrated embodiments of the invention, the channels are in fluid communication with one another through a plurality of openings 39 in each of the seams 37. The sizes and locations of the openings 39 can be varied to achieve a desired response. Alternatively, openings 39 can be omitted, and each channel 38 will be completely sealed unto itself.

[0018] The fluid in the cushion can be air, gas or gas mixtures, liquid, or a flowable gel. The cushion should be only partially filled with fluid, so that the fluid can move from one

region of the cushion to another, or from one region in a channel to another, in response to variations in applied pressure caused by movements of the user.

[0019] In use, when a user of the chair leans against the backrest 12, the user's back will be in contact with forward surface 14 and exert pressure thereon. The user's upper back and shoulders will cause some compression of partially filled channels 38 primarily in upper region 42, causing fluid to be driven into lower lumbar region 40 where it will provide additional support to the user's lumbar region, where such support often is most needed. It may be seen that the exact location of the additional lumbar support along the length of channels 38 will be determined automatically by the physical dimensions of each individual user. It is not necessary for an individual user to make manual adjustments to the chair in order to obtain optimum support in the lumbar region. Thus, the fluid support system of the instant invention provides an automatic passive adjustable support of the lumbar region, responsive to each individual user. The inventive system advantageously applies equalized pressure along the user's back.

[0020] Moreover, when a user reclines the backrest 12 of chair 10, the individual's spinal curvature will change, with the manner and amount of change depending on the individual's physical dimensions and the angle of inclination of the backrest. The lumbar region 19 of rigid support member 18 is curved to conform generally to the lumbar region of a user. Generally, the radius of curvature of a user's back will be smaller than the radius of curvature of lumbar region 19 of rigid support member 18. The space between the user's lumbar region and lumbar region 19 of rigid support member 18 defines a relatively small volume to be filled with fluid. As the seat back reclines, the user's spinal curvature changes, and in particular the arch of the user's lumbar region and upper back.

The areas of pressure exerted by the user's back when reclined will vary along the length of the channels 38. Fluid within the partially filled channels will shift away from the areas where pressure is greatest, such as region 42 contacted by the user's upper back and shoulders, and towards the areas where pressure is least, such as region 40 at the user's lumbar area. Typically, it is the lumbar region where support is needed most. The shifting of fluid within the channels 38 will happen automatically as the user alternately reclines and straightens the back rest. At the same time, there will be less fluid volume in the cushion in upper-back region 42, such that there will be greater stability of the user's upper back, with no unwanted side-to-side rolling motion. Thus the fluid-containing cushion of the instant invention automatically adjusts to the needs of different individual users, and to the different needs of a single individual as that user assumes different angles of inclination and different positions during the course of ordinary use of the chair. Advantageously, the user will not feel any discontinuity in pressure or support in the lumbar region, regardless of the angle of inclination; i.e., there is no "edge" where lumbar support ends, as can be experienced with systems that employ a discrete mechanical lumbar support member.

[0021] It will be appreciated that the channels 38 preferably are not filled to their highest capacity. If the pressure in the channels 38 were too high, then the cushion 30 would not yield in response to unevenly applied pressures; i.e., the fluid would not be able to shift from a region of higher applied pressure such as the shoulder and upper back region 42 to a region of lower applied pressure such as lumbar region 40.

[0022] The cushion of the instant invention can be manufactured of fluid-impermeable plastic films that can be sealed together to form hermetic seals. Such plastic films can

include, for example, vinyls, polyurethanes, polyvinyl chlorides, ethylene vinyl acetates, urethane coated membranes, polyolefins, sarans, and engineered multi-layer films. The plastic film selected for the cushion will be practically air-impermeable, having an air transmissibility rate as measured by ASTM D1434 (Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting) of less than about 100 $cm^3/m^2/day/atm$; preferably less than about 10 $cm^3/m^2/day/atm$; and most preferably less than about 5 $cm^3/m^2/day/atm$. The thickness of the plastic film can be in the range of about 2-20 mil, more preferably about 4-10 mil, and optimally about 4 mil. One particularly preferred material for an air-containing cushion is 4.0 mil Saranex 15, a multi-layer film available from Dow Medical Films and comprising a "Saran®" barrier resin co-extruded between outer layers of polyolefins. The films can be sealed together to form periphery seal 36 and seams 37 by known sealing means, such as adhesives, heat sealing, ultrasonic sealing, and RF sealing. Those skilled in the art will be able to select a sealing means suitable for the particular film material being used. A desired amount of air is injected into the various chambers of the cushion during the sealing process by methods known in the art of the manufacture of air-filled bladders.

[0023] The dimensions of the cushion, and the size, number, and angular orientation of channels 38 of the cushion, can be varied to accommodate (1) the needs of different users; (2) the design of the chair as a whole, including whether any optional pads of foam or other resilient material are used in front of and/or behind the cushion, and the characteristics of the optional pads; and (3) the different applications for which the chair will be used. The size and number of the openings 39 also can be varied to achieve a

desired fluidic response. Further, additional padding such as a foam layer or a gel layer can be interposed between cushion 30 and upholstery layer 20.

[0024] FIG. 4 illustrates a preferred embodiment of a back rest cushion generally indicated at reference numeral 130. Cushion 130 comprises two sheets of plastic film sealed together with a peripheral seal 136. Extending the full length of cushion 130 are two seams, 134, 135, that divide the interior of cushion 130 into a central chamber 139 and two side chambers 138. In this embodiment, each of central chamber 139 and side chamber 138 is partially inflated with air. Partial seams 137 in each side chamber 138 extend from about the top of each side chamber 138 down to about the vertical midpoint thereof. These partial seams 137 prevent side chambers 138 from bulging too much at the upper end, and maintain a more uniform pressure level throughout the length of the cushion. It will be understood that partial seams 137 could be in the forms of spot welds, i.e., discrete spots where the two layers of cushion 130 are bonded together. Such spots could be arranged in lines or over an area, as long as they serve to moderate expansion of side chambers 138. In the illustrated embodiment, partial seam 137 terminates in a tear-drop shaped element, which relieves localized stresses in the plastic sheets.

[0025] In the illustrated embodiment, the cushion 130 is about 18 inches high and about 14 inches wide along its top horizontal edge 150. The sides taper inward slightly beginning about six inches from the bottom edge, such that the width of the bottom edge 152 is about 10 inches. Center chamber 139 is pressurized with about 100 cubic centimeters of air, and side chambers 138 are each pressurized with about 300 cubic centimeters of air. Alternatively, an external pump can be provided so that the user can adjust the amount of air in the cushion in accordance with individual preferences.

[0026] The present invention provides a significant improvement over prior art back rest supports. Unlike foam pads, which simply compress in response to applied pressure, the fluidic support of the present invention redistributes pressure, such that as one part of the cushion compresses, another part expands, to provide additional support where it is needed most.

[0027] While the novel features of the present invention have been described with respect to particular embodiments, it will be appreciated by those skilled in the art that substitution of materials and modifications as to structure and details can be made without departing from the spirit of the invention.